§27. Wall Conditionings for DD Discharge Phase in LHD by Inert Gas Glow Discharges

Hino, T., Yamauchi, Y. (Hokkaido Univ.),
Nishimura, K.

In the next phase of LHD experiment, DD discharge has been scheduled. In order to evaluate the deuterium and tritium retention at the wall and to reduce such the retention, simulation experiments based upon the glow discharges have been conducted at Hokkaido University. The first wall material in LHD is stainless steel, SS 316L. For the SS 316L wall, the amount of retained deuterium after the deuterium discharge, and the removal ratios of the deuterium retention followed by He, Ne and Ar glow discharge have been systematically obtained.

The amount of retained deuterium was 5.5×10^{16} D/cm^2, which was comparable with the hydrogen retention previously obtained [1]. In the initial phase of the DD experiment in LHD, the hydrogen is well retained at the wall. Thus, this hydrogen retention has to be reduced before the DD main discharge. Figure 1 shows the change of partial pressures during D_2 glow discharge after H_2 glow discharge. Approximately 60% of retained hydrogen was removed by this 2hr D_2 glow discharge. This result indicates that a few hrs D_2 glow discharge is required for reduction of the hydrogen retention.

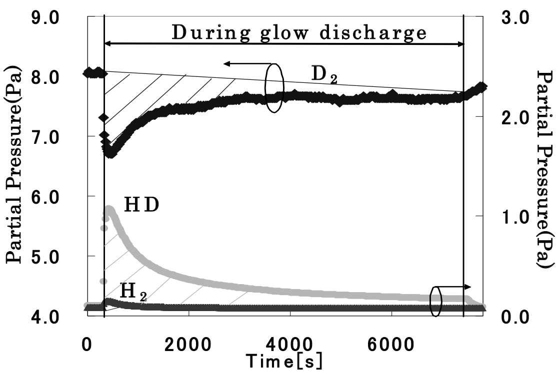

Fig.1 Change of partial pressures during D_2 discharge after H_2 discharge.

In order to reduce the deuterium retention, the inert gas glow discharges were conducted after the deuterium discharge. Figure 2 shows the change of partial pressures during He glow discharge after the D_2 glow discharge. Approximately 45 % of deuterium retention was removed by the He glow discharge. Figures 3 and 4 show the changes of partial pressures during the Ne and the Ar glow discharges, respectively. The removal ratios were 30 % and 15 % for the Ne and the Ar glow discharges, respectively. It was seen that the He glow discharge was most suitable for reduction of the deuterium retention. However, the blisters are formed by the He glow discharge, and the helium is well trapped in the wall. The use of the Ne glow discharge may be better to avoid these problems. In the case of the Ar glow discharge, the wall surface is quickly covered by the deposition particles, so that the removal ratio does not become high. This is the reason for the small removal ratio in the case of Ar glow discharge.

In the present study, the deuterium retention and desorption behavior in SS wall was investigated, and the suitable wall conditioning using the glow discharge was suggested. Similar experiment will be conducted for tungsten wall [2].

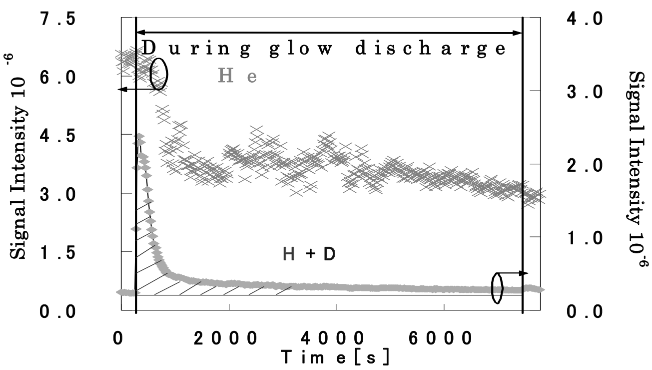

Fig.2 Change of partial pressure during He glow discharge.

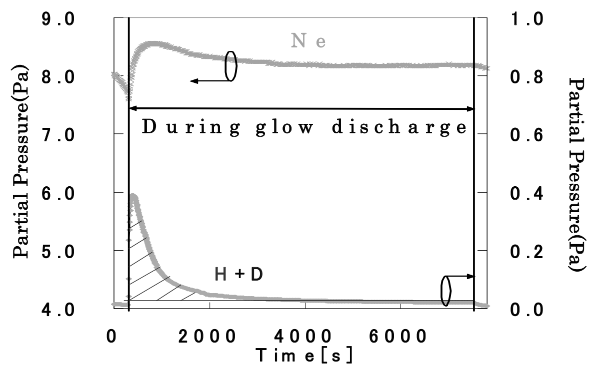

Fig.3 Change of partial pressure during Ne glow discharge.

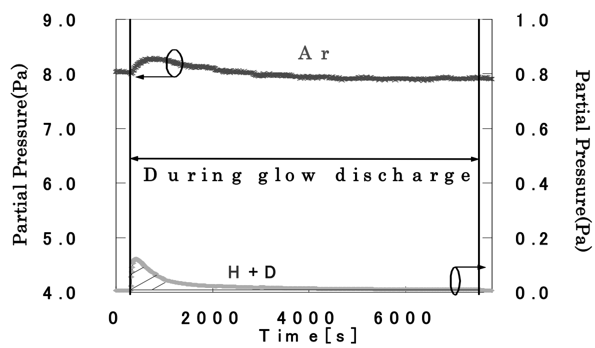

Fig.4 Change of partial pressure during Ar glow discharge.

1)T.Hino et al, "Performances of inert gas glow discharges for reductions of fuel hydrogen retention and helium retention", To appear in Fusion Eng. and Design (2010).
2)T.Hino et al, "Retention and desorption behavior of hydrogen isotope in tungsten plasma facing wall", To be presented in 3rd China-Japan Workshop on the tritium and breeding blanket technology, Kunming, Jun., 2010.